

1/2

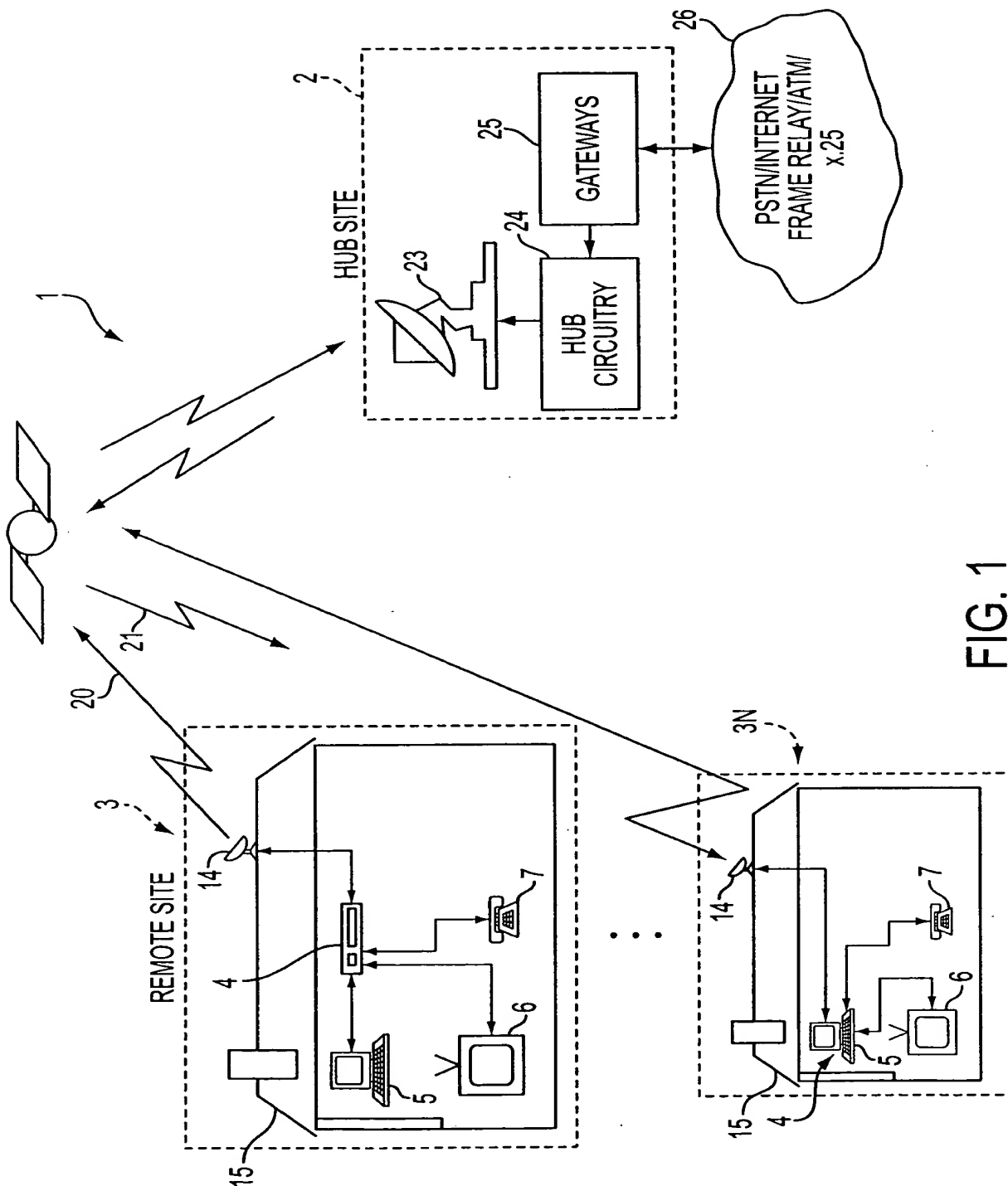


FIG. 1

2/2

As a background we assume familiarity of the slotted ALOHA ("RA") model, $S = G * P_{\text{success}}$, where $P_{\text{success}} = \exp(-G)$.

Notation

S1 Throughput generated by VSATs with Controlled RA (CRA) allocation
 G1 Load generated by VSATs with CRA allocation
 S2 Throughput generated by VSATs who don't have CRA allocation
 G2 Load generated by VSATs who don't have CRA allocation

Relation Explanation
 $S1 = G1 * \exp(-G2)$ Transmissions of VSATs with CRA collide with G2 only.
 $S2 = G2 * (1 - G1) * \exp(-G2)$ Non-CRA VSAT transmissions collide with both. G1 loads the inbound in a single burst per time/freq-slot manner.
 G2 loads the inbound as in ALOHA-a few bursts may show up in a single time/freq-slot.

More notations:

P Fraction of traffic that is sent by VSATs with CRA allocation
 S Total throughput
 P_{scs} Prob of success in Slotted ALOHA
 P_{scs_1} Prob of success for those VSATs with CRA allocation
 P_{scs_2} Prob of success for those VSATs with no CRA allocation

More Relations

$S1 = S * p$
 $S2 = S - S1 = S * (1 - p)$
 $P_{\text{scs}} = \exp(-G)$ where G satisfies $S = G * P_{\text{scs}}$
 $P_{\text{scs}_1} = \exp(-G2)$. $P_{\text{scs}_2} = (1 - G1) * \exp(-G2)$.
 where G1 and G2 satisfy $S1 = G1 * P_{\text{scs}_1}$, and $S2 = G2 * P_{\text{scs}_2}$
 $S2/S1 = G2/G1 * P_{\text{scs}_2}/P_{\text{scs}_1} = G2/G1 * (1 - G1)$
 therefore $G2 = S2/S1 * G1/(1 - G1)$

Here is a spreadsheet that calculates these formulas for $p=80\%$.

S	For RA			For CRA with proportion of CRA traffic, $p=80.0\%$						Verification through calculating			Avg P_{scs}
	G	P_{scs}		S1	S2	G1	G2	P_{scs_1}	P_{scs_2}	delta-S1	delta-S2	delta-S	
10.0%	11.2%	89.4%		8.0%	2.0%	8.2%	2.2%	97.8%	89.8%	3.281E-05	8.2E-06	-2.3E-07	96.2%
15.0%	17.9%	83.6%		12.0%	3.0%	12.4%	3.5%	96.5%	84.6%	0.0004916	0.000123	4.73E-05	94.1%
20.0%	25.9%	77.2%		16.0%	4.0%	16.8%	5.1%	95.1%	79.1%	6.722E-05	1.68E-05	3.29E-06	91.9%
<u>25.0%</u>	35.7%	<u>70.0%</u>		20.0%	5.0%	21.4%	6.8%	93.4%	73.5%	0.0003088	7.72E-05	9.95E-06	89.4%
30.0%	48.9%	61.3%		24.0%	6.0%	26.1%	8.8%	91.5%	67.6%	0.000915	0.000229	9.58E-06	86.8%
35.0%	71.7%	48.8%		28.0%	7.0%	31.4%	11.4%	89.2%	61.2%	4.496E-05	1.12E-05	2.4E-06	83.6%
40.0%				32.0%	8.0%	37.0%	14.7%	86.3%	54.4%	0.0004309	0.000108		79.9%
45.0%				36.0%	9.0%	43.7%	19.4%	82.4%	46.4%	0.000133	3.33E-05		75.2%
<u>48.7%</u>				39.0%	9.7%	49.8%	24.8%	78.0%	39.2%	0.0009785	0.000245		<u>70.3%</u>
50.0%				40.0%	10.0%	53.0%	28.2%	75.4%	35.5%	0.0002245	5.61E-05		67.4%

FIG. 2